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GB 2296879 A EP 0923992 A EP 0728435 A
EP 0636338 A EP 0042723 A

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(54) Abstract Title
An upright cyclone vacuum cleaner

(57) An upright vacuum cleaner comprising a body (10) having a dust chamber (11) and a motor chamber, a suction brush (20) connected to the body, and a removable dual cyclone-type dust collecting means (30) comprising an upper cover 140 having a first air inlet 141 and an air outlet 142, a cylindrical outer cyclone receptacle 160 having open ends and being coupled to the upper cover, an inner cyclone receptacle 150 coupled to the upper cover and a removable lower cover 170 to allow removal of collected dust. The inner cyclone receptacle may comprise a grille 151 with a plurality of holes and a second air inlet 152.

A further cleaner is claimed having a single cyclone dust collecting means.

FIG.2

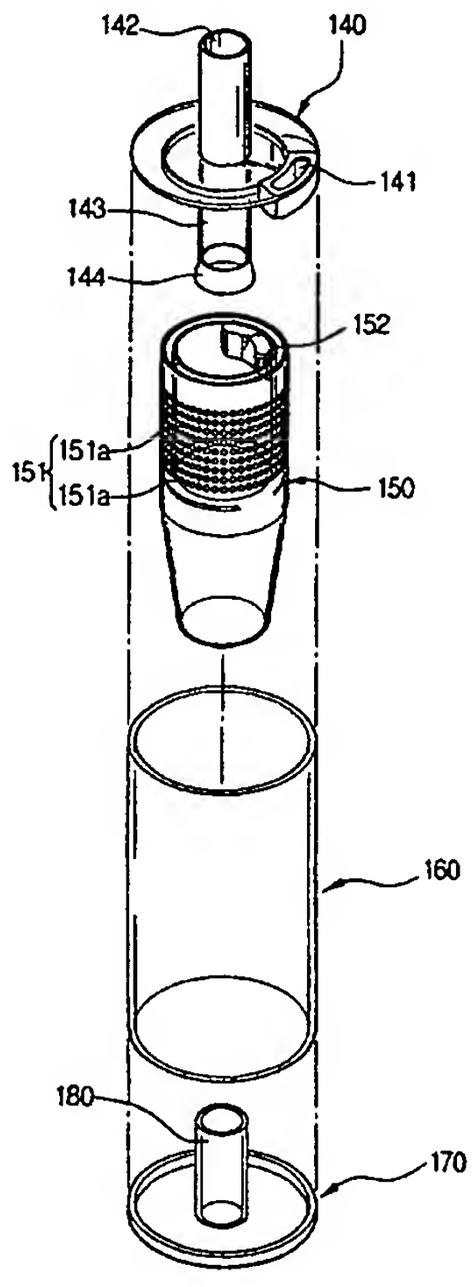

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FIG.1

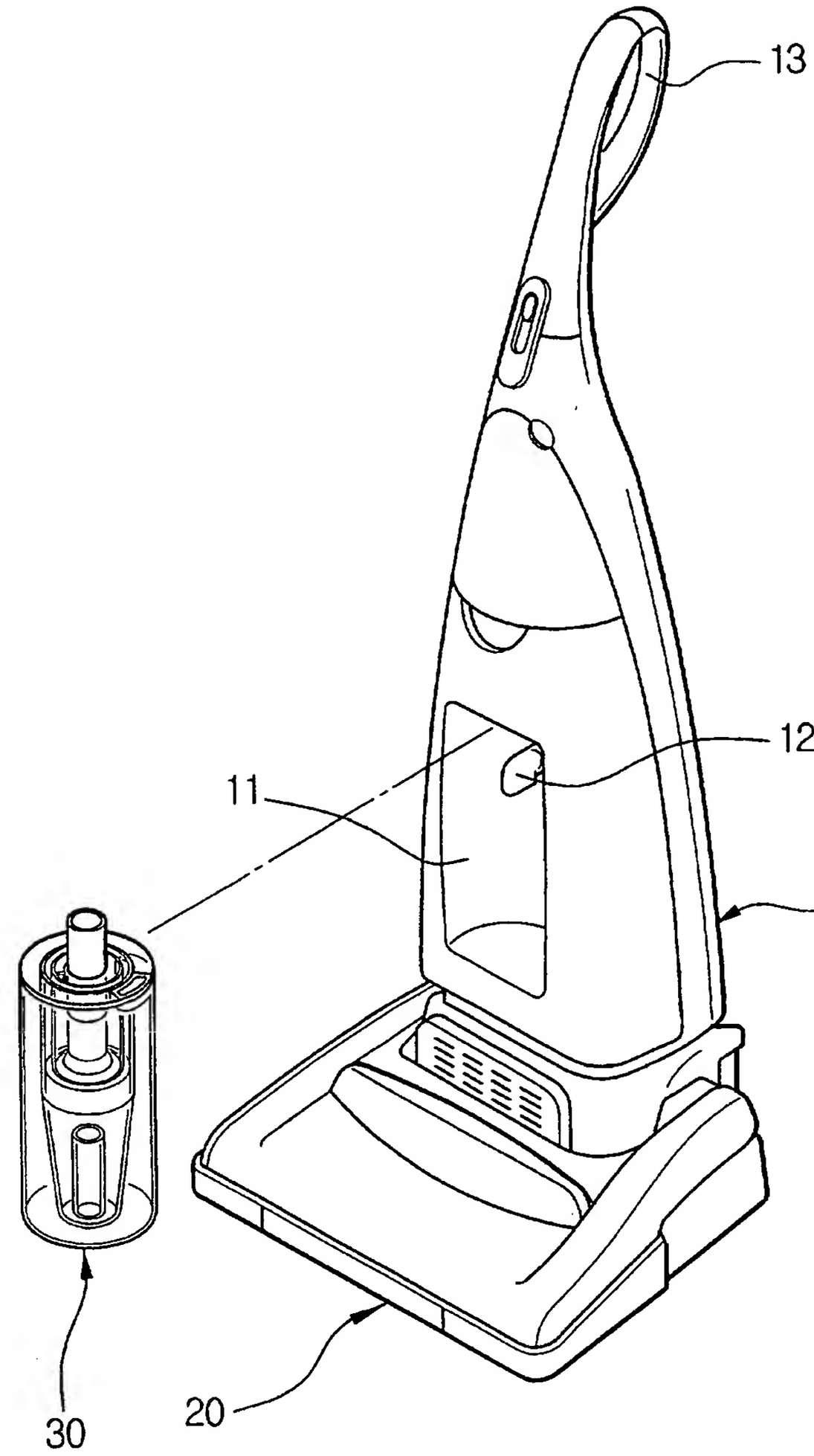


FIG.2

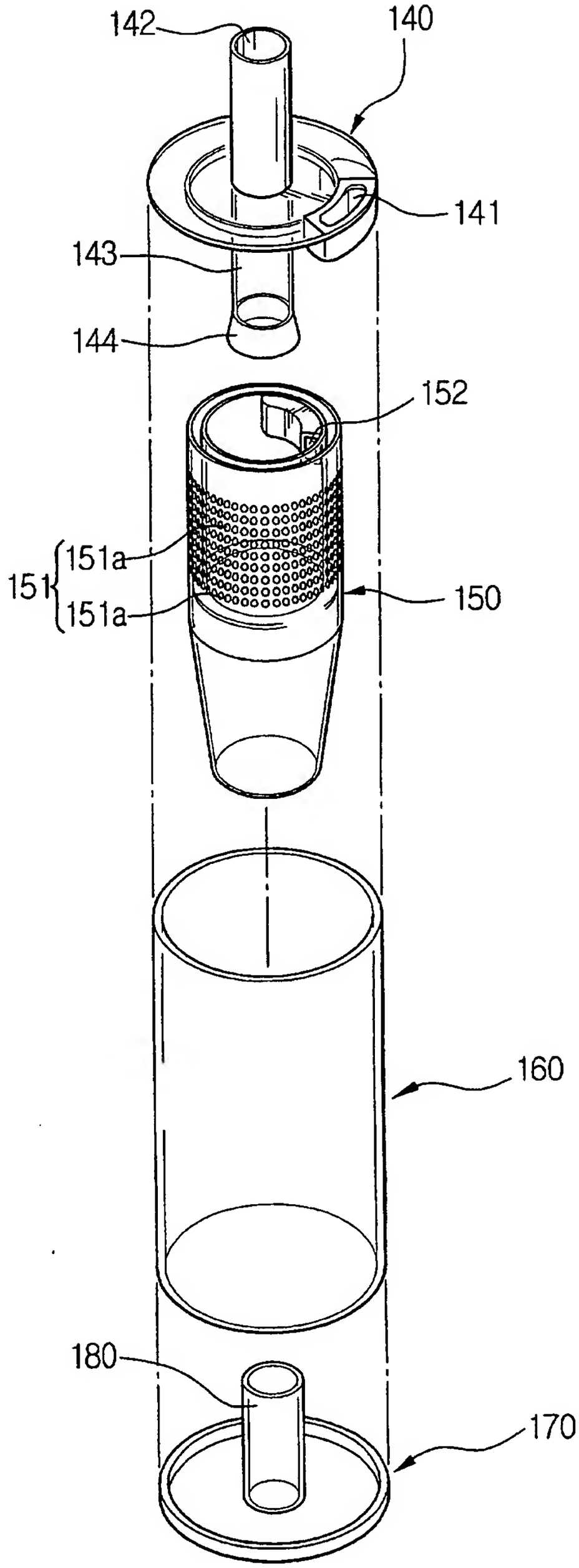


FIG.3

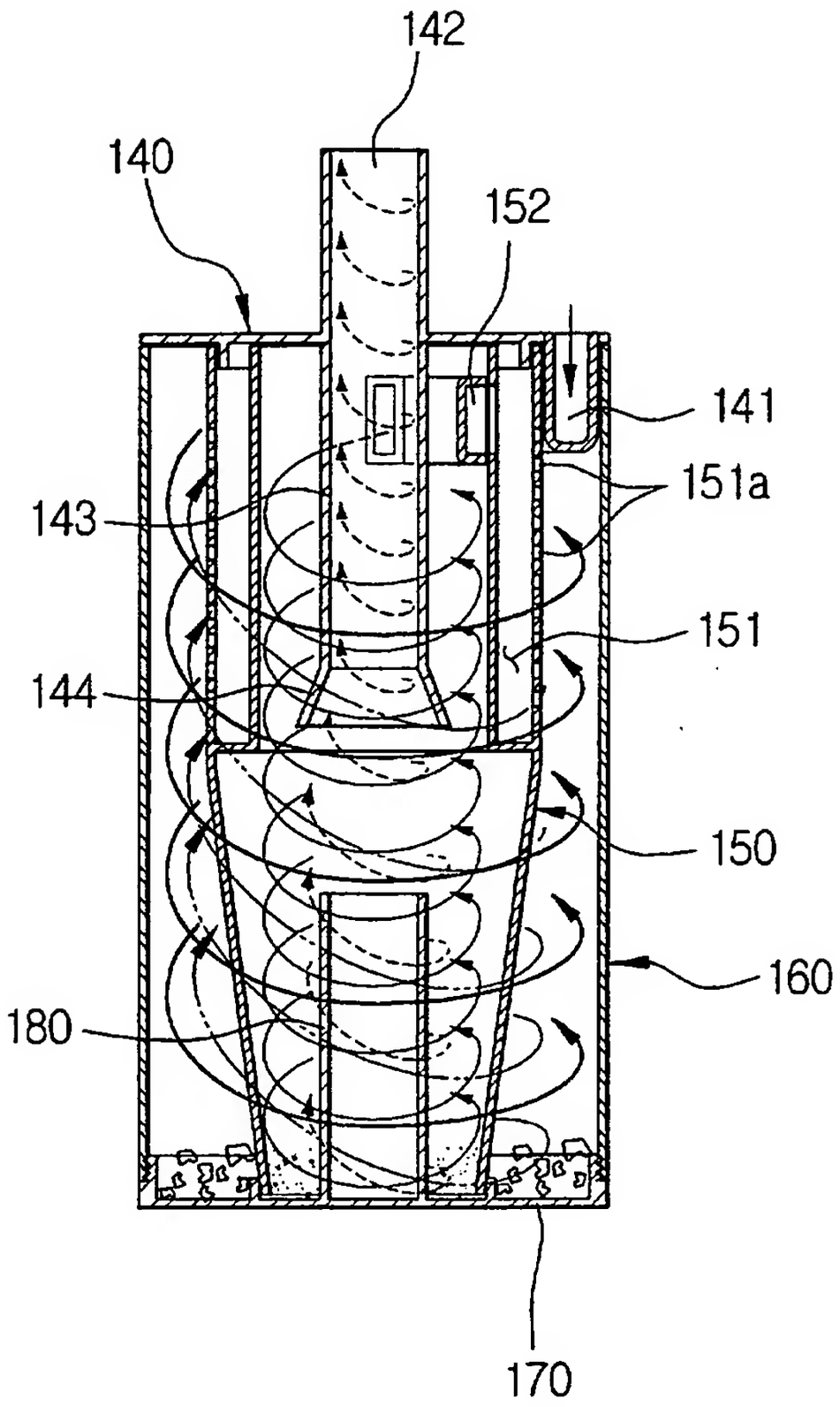


FIG.4

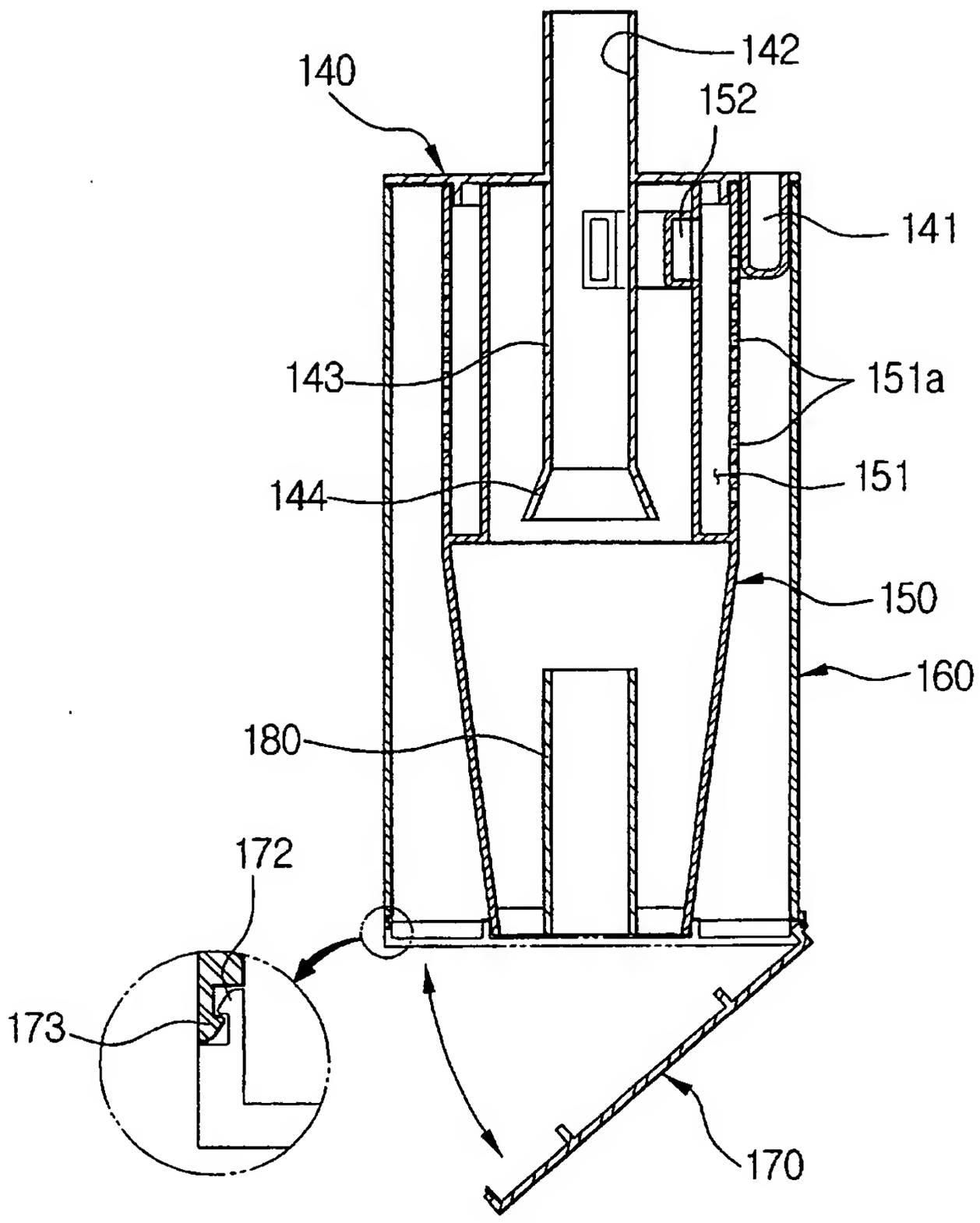


FIG.5

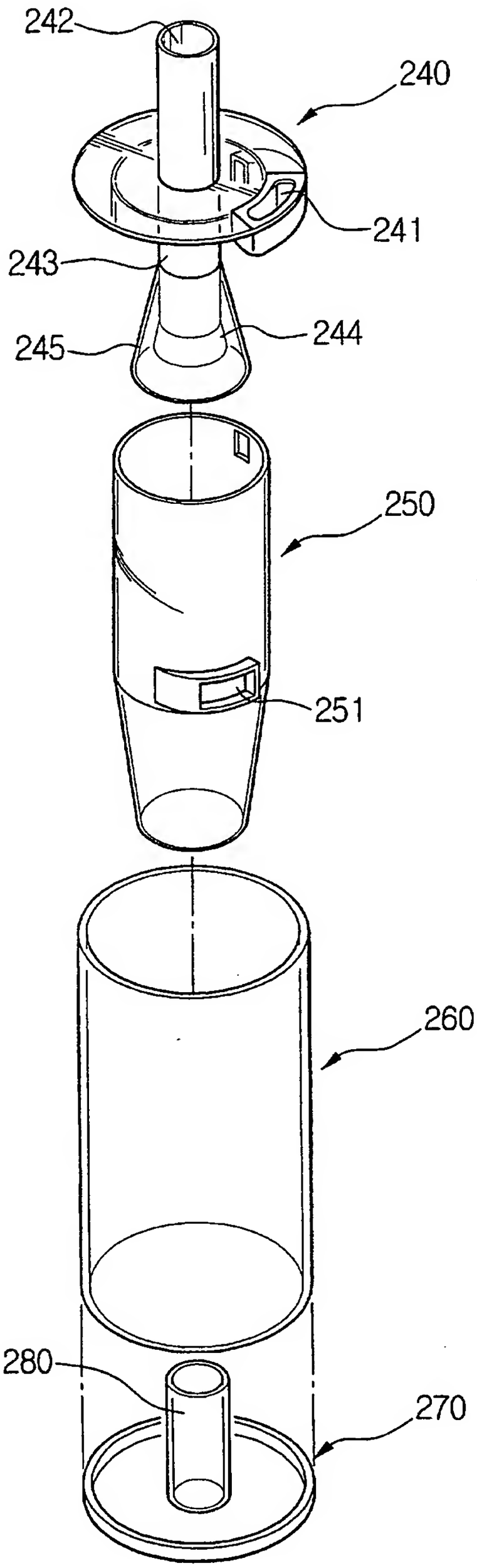


FIG.6

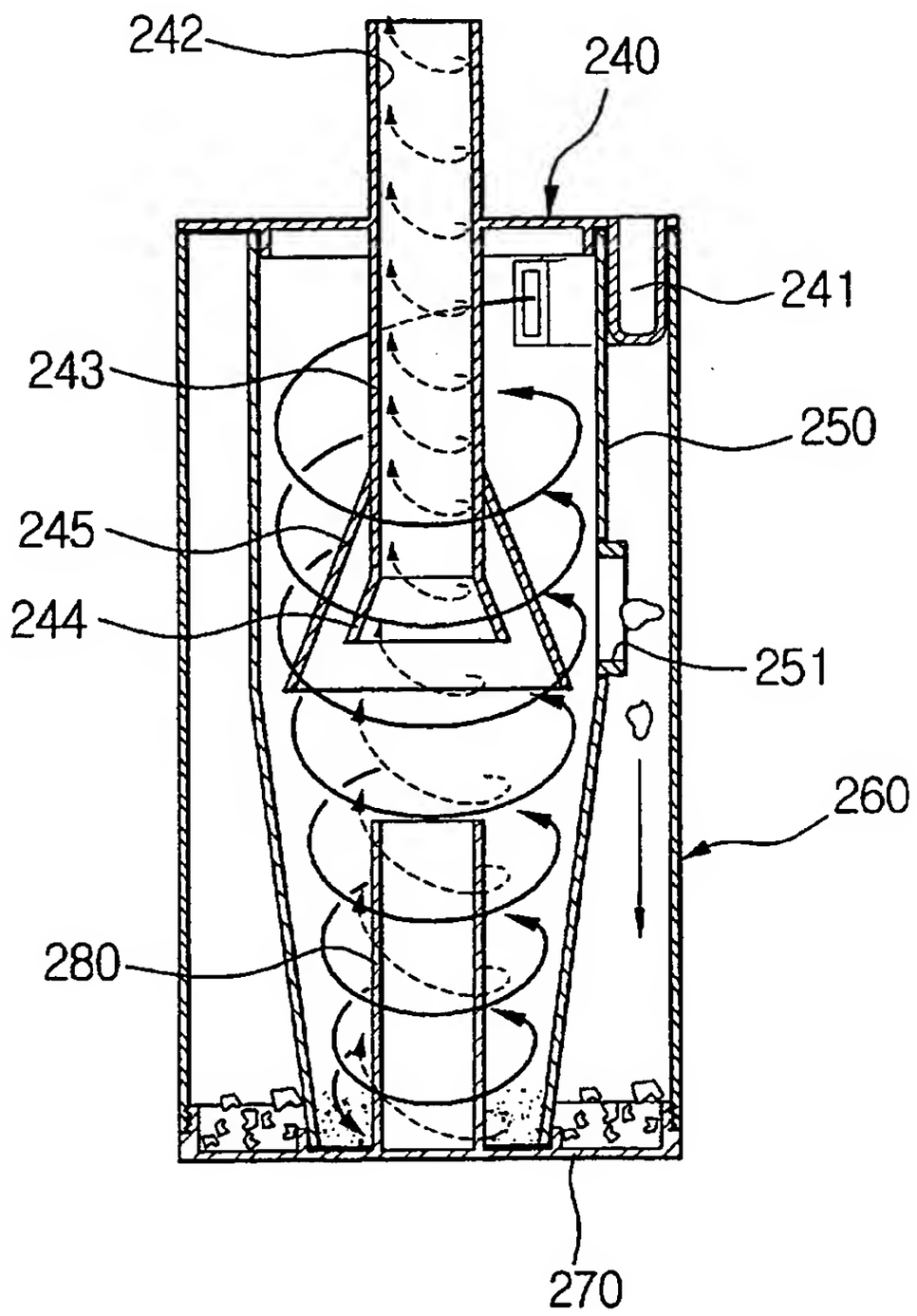


FIG.7

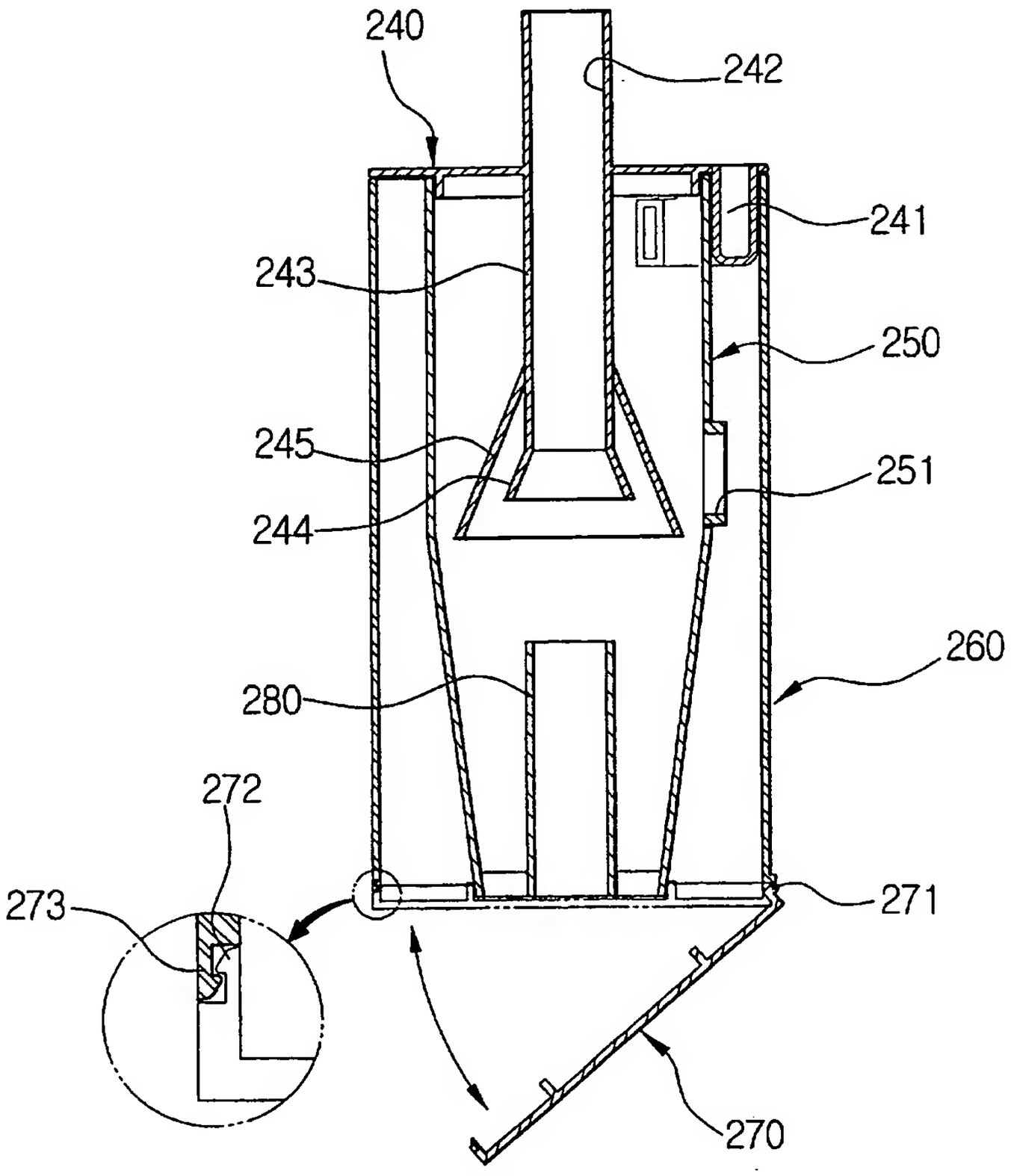
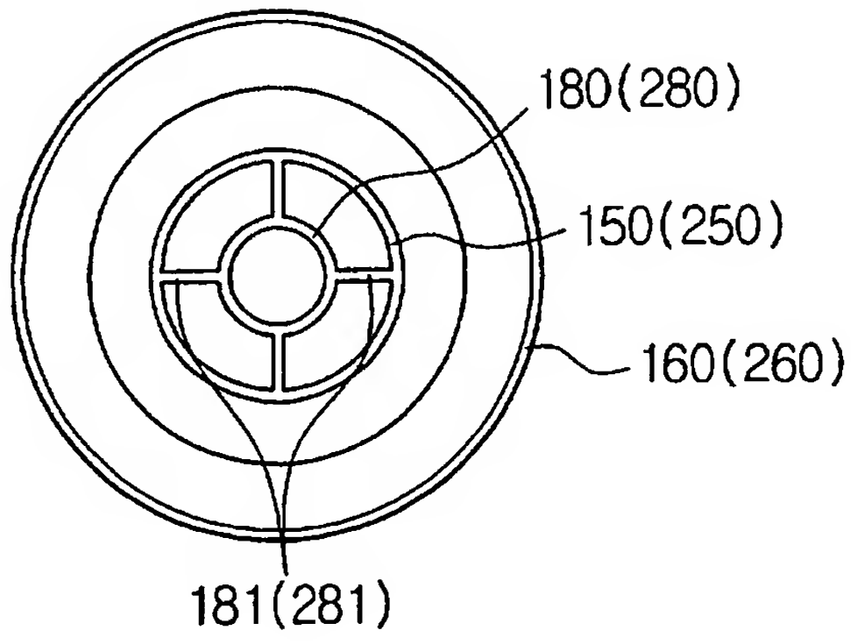


FIG.8



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UPRIGHT-TYPE VACUUM CLEANER

The present invention relates to an upright-type vacuum cleaner, and more particularly, to an upright-type vacuum cleaner having a cyclone-type dust collector capable of separating by centrifugal force and collecting contaminants from the air drawn into the vacuum cleaner through a suction brush, thereby eliminating the need for a dust filter.

Generally, an upright-type vacuum cleaner includes a suction brush or suction head which is attached to a lower end of a vacuum cleaner body and which moves along a cleaning surface. The cleaner body includes an inner space that is divided into a dust chamber and a motor chamber. A dust filter is removably disposed in the dust chamber, and a motor is disposed in the motor chamber.

When the motor operates, a strong suction force is generated at the suction brush, and dust and other contaminants on the cleaning surface are drawn into the cleaner body together with ambient air. After being drawn in, the air is discharged from the cleaner body via the dust filter in the dust chamber. Accordingly, contaminants are filtered out by the dust filter, while the clear air is discharged from the cleaner body via the motor chamber.

Such a general upright-type vacuum cleaner, however, requires a dust filter and a dust chamber, in which contaminants are removed from the air by the dust filter. The dust filter is an expendable item that the user has to obtain separately for future use. Furthermore, when the dust filter is clogged with contaminants, the user must manually replace the dust filter. Manual replacement of a dirty dust filter is both inconvenient and unhygienic.

It is an object of the present invention to provide an improved upright-type vacuum cleaner having a cyclone-type dust collector for semi-permanent use. Accordingly, the present invention provides an upright-type vacuum cleaner including a cyclone-type dust collector removably disposed in the vacuum cleaner. Using centrifugal force, the

dust collector separates and collects dust and other contaminants from the air that is drawn in through a suction brush into a dust chamber in the vacuum cleaner. The dust collector can be removed from the vacuum cleaner body and replaced after the contaminants collected therein have been emptied out.

According to one aspect of the invention the dust collector includes an upper cover, an outer cyclone receptacle coupled to the upper cover, an inner cyclone receptacle also coupled to the upper cover, and a lower cover. The upper cover has a first air inlet, corresponding to a suction hose for connecting the suction brush and the dust chamber, and an air outlet, corresponding to an exhaust hose for connecting the dust chamber and a motor chamber. The outer cyclone receptacle, which is substantially cylindrical, has open upper and lower ends. The inner cyclone receptacle is disposed in the outer cyclone receptacle. The lower cover is removably mounted on a lower opening of the outer cyclone receptacle to allow disposal of dust and contaminants, which have been collected in the inner and outer cyclone receptacles.

In one embodiment of the invention, the inner cyclone receptacle includes a grille having a plurality of fine holes formed therein, and a second air inlet for guiding the air, which ascends in a reverse direction from the bottom of the outer cyclone receptacle, through the grille and into a vortex. A centrifugal force of the vortex separates and collects the dust and contaminants from the air. In this case, it is preferable that the first and second air inlets of the upper cover partially overlap each other.

In another preferred embodiment of the present invention, the first air inlet opens into the inner cyclone receptacle and guides the air, containing dust and contaminants, into a vortex having a centrifugal force, by which the contaminants are separated and collected in the inner cyclone receptacle. The inner cyclone receptacle has a contaminant outlet, through which the contaminants that have been separated from the air are discharged into the outer cyclone receptacle.

Advantageously, the upper cover includes an outlet pipe which extends downwardly from the air outlet, and which has a first skirt that extends downwardly from an end.

The skirt has a gradually increasing diameter for preventing contaminants collected in the inner cyclone receptacle from floating upward. The outlet pipe may include, in addition, a second skirt that extends downwardly from a middle level of the outlet pipe. This second skirt has a gradually increasing diameter for guiding contaminants through the contaminant outlet.

Furthermore, the inner cyclone receptacle may taper downwardly from the middle level thereof. The downward tapering of the inner cyclone receptacle gradually increases a gap between the inner and outer cyclone receptacles and thereby decreases the flow velocity of the air and reduces the possibility of a reverse flow of contaminants collected in the outer cyclone receptacle.

Another preferred feature is a reverse flow prevention pipe extending a predetermined height from the centre of the inner cyclone receptacle to guide the vortex of air that ascends in a reverse direction from the bottom of the inner cyclone receptacle and to hinder a reverse flow of contaminants.

The lower cover may be detachably screwed onto the lower opening of the outer cyclone receptacle, and the reverse flow prevention pipe may be integrally formed at the centre of the lower cover.

One side of the lower cover may be hingedly connected to the lower end of the outer cyclone receptacle. On the other side of the lower cover, a locking feature may be formed for engaging a corresponding locking feature formed on the outer cyclone receptacle to secure the lower cover to the outer cyclone receptacle. The lower cover provides access to the inside of the inner and outer cyclone receptacles, facilitating disposal of contaminants collected therein. In this case, the reverse flow prevention pipe is integrally formed on a lower opening of the inner cyclone receptacle by a plurality of ribs or spokes.

The invention will now be described by way of example with reference to the drawings, in which:

Figure 1 is a perspective view of an upright-type vacuum cleaner in accordance with the present invention, having a cyclone-type dust collector;

Figure 2 is an exploded perspective view of the dust collector appearing in Figure 1;

Figure 3 is a sectional view of the dust collector of Figure 2 in an assembled state;

Figure 4 is a sectional view of an alternative cyclone-type dust collector;

Figure 5 is an exploded perspective view of a third cyclone-type dust collector;

Figure 6 is a sectional view of the dust collector of Figure 5 in an assembled state;

Figure 7 is a sectional view of a fourth cyclone-type dust collector; and

Figure 8 is an underside view of a cyclone-type dust collector illustrating a reverse flow preventing bar connected by spokes.

Referring to Figure 1, an upright-type vacuum cleaner in accordance with the present invention includes a body 10, a suction brush 20, and a cyclone-type dust collector 30.

The body 10 has a dust chamber 11 and a motor chamber (not shown). A handle 13 is formed on an upper side of the body 10. The suction brush 20 is pivotally connected to a lower end of the body 10 and is capable of rotating through a predetermined angle. The cyclone-type dust collector 30 is removably mounted in the dust chamber 11 of the body 10.

The dust chamber 11 has an air inlet 12 and an air outlet (not shown) formed therein. The air inlet 12 is connected to the suction brush 20 through a suction hose, while the air outlet is connected to the motor chamber through a conduit (not shown) formed in the vacuum cleaner body. After flowing through the suction brush 20, the suction hose,

and the air inlet 12, the air, along with dust (minute particles) and other contaminants (larger particles), flows into the dust chamber 11. The air is discharged to the outside atmosphere through the air outlet, a conduit of the cleaner body 10, and the motor chamber, while the contaminants of the air are filtered out by the dust collector 30.

As shown in Figures 2 and 3, the dust collector 30 separates dust and contaminants from the air using centrifugal force, and includes an upper cover 140, a substantially cylindrical inner cyclone receptacle 150, a substantially cylindrical outer cyclone receptacle 160, and a lower cover 170.

The upper cover 140 is disc-shaped, and includes an air inlet 141 and an air outlet 142. When the dust collector 30 is mounted in the dust chamber 11 of the cleaner body 10, the air inlet 141 and air outlet 142 of the cyclone-type dust collector 30 are connected with the respective air inlet 12 and outlet of the dust chamber 11. In this embodiment, the air inlet 141 of the cyclone-type dust collector 30 is formed on an edge of the upper cover 140 to guide the air in a diagonal or generally tangential direction with respect to the outer cyclone receptacle 160 when the air is drawn therethrough. The air outlet 142 of the dust collector 30 is formed in a centre of the upper cover 140.

The outer cyclone receptacle 160 has open upper and lower ends. The upper end of the cyclone receptacle 160 is joined to the upper cover 140. The outer cyclone receptacle 160 separates, using centrifugal force, the large particle contaminants from the air by inducing the air into a vortex through a cooperation of the outer cyclone receptacle 160 and the upper cover 140. The vortex of air descends toward the bottom of the outer cyclone receptacle 160, where it then ascends in a reverse direction.

The inner cyclone receptacle 150 is also joined to the upper cover 140, and is disposed coaxially within the outer cyclone receptacle 160. The inner cyclone receptacle 150 includes a grille 151 having a plurality of fine holes 151a formed therein, and a second air inlet 152. The air that ascends from the bottom of the outer cyclone receptacle 160 passes through the fine holes 151a of the grille 151, and into the second air inlet 152 and inner cyclone receptacle 150 in a diagonal or tangential direction. Accordingly, the

inner cyclone receptacle 150 induces the air into a second vortex, and minute particle dust is separated from the air by centrifugal force, and falls to the bottom.

It is preferable that the first air inlet 141, which is formed on the upper cover 140, and the second air inlet 152, which is formed on the inner cyclone receptacle 150, partially overlap each other.

The vortex of air descending in the inner cyclone receptacle 150 ascends in the reverse rotational direction after reaching the bottom, and is discharged through the air outlet 142 of the upper cover 140.

The dust collector 30 further includes an outlet pipe 143 that extends downward by a predetermined depth from the air outlet 142. The outlet pipe 143 guides the discharged air and has a skirt 144 that extends downwardly from a lower end of the outlet pipe 143. The skirt 144 has a gradually increasing diameter as it extends toward the lower end of the outlet pipe 143 to prevent dust and contaminants from ascending together with the ascending vortex air. The skirt 144 increases minute particle dust collecting efficiency by increasing the flow velocity of ambient air. Furthermore, a plurality of spiral grooves (not shown) are formed on an outer circumference of the outlet pipe 143 to increase centrifugal force.

Owing to the inner cyclone receptacle 150 being downwardly and inwardly tapered, the diameter gradually decreasing from a middle level of the receptacle to the lower end, the gap between the inner and outer cyclone receptacles 150 and 160 gradually increases, and accordingly, the air flow velocity gradually decreases, hindering a reverse flow of the contaminants that have been collected at the bottom of the outer cyclone receptacle 160.

The lower cover 170 is removably mounted on a lower opening of the outer cyclone receptacle 160 to allow disposal of contaminants therethrough. Such a lower cover 170 is preferably screwed onto the outer cyclone receptacle 160.

Extending upwardly from the centre of the lower cover 170, there is a reverse flow prevention pipe 180. This extends upwardly by a predetermined height to hinder more efficiently reverse flow of minute particle dust collected in the inner cyclone receptacle 150. That is, due to the presence of the reverse flow prevention pipe 180, the air around the central area of the inner cyclone receptacle 150 ascends directly. Accordingly, movement of the dust is minimised, and reverse flow of the dust can be also prevented. Any reverse flow of large particle contaminants with the ascending vortex air, is countered by the filtering effect of the fine holes 151a of the grille 151, and the particles falling to the bottom.

Referring to Figure 3, air, and dust and contaminants entrained in the air, flow into the outer cyclone receptacle 160 with a rotational component through the first air inlet 141 of the upper cover 140, forming a vortex current of air in the outer cyclone receptacle 160. Due to the centrifugal force of the vortex of air, large particle contaminants (e.g., contaminants that are larger than the fine holes 151a of the inner cyclone receptacle 150) are separated and fall to the bottom of the outer cyclone receptacle 150.

Next, as the air reaches the bottom of the outer cyclone receptacle 150, the air and minute particle dust entrained therein ascend in a reverse direction and flow through the fine holes 151a of the grill 151 of the inner cyclone receptacle 150, the second air inlet 152, and then into the inner cyclone receptacle 150 with a rotational component. The inner cyclone receptacle 150 generates a second vortex of air. Here, due to centrifugal forces, the minute particle dust is separated from the air and falls, and is collected at the bottom of the inner cyclone receptacle 150. Since the flow velocity of the descending air is increased due to the presence of the skirt 144, the minute dust collecting efficiency is improved, while the larger particle contaminants collected in the inner cyclone receptacle 150 do not flow in the reverse direction but rather remain in the bottom portion of the inner cyclone receptacle 150.

When the descending air finally reaches the bottom of the inner cyclone receptacle 150, the air ascends in a reverse direction and is discharged to the outside atmosphere through the outlet pipe 143.

Accordingly, the dust and contaminants are separated from the air through two processes using centrifugal force, whereby separating and collecting the minute particle dust and large particle contaminants can be more efficiently performed.

Later, when the cyclone receptacles 150 and 160 are filled with contaminants, the user can separate the receptacles 150 and 160 from the cleaner body 10, and dump the collected dust and contaminants by opening the lower cover 170 .

Referring to Figure 4, in a second preferred embodiment of the invention, the basic structure employed in the second embodiment is substantially the same as that of the first embodiment, and further description thereof is therefore omitted. Like elements have the same reference numerals throughout the description and drawings. Accordingly, the main differing element of the second embodiment, i.e., the lower cover 170, will be described in greater detail below.

As shown in Figure 4, in the cyclone-type dust collector of the second embodiment, the lower cover 170 is not completely detachable from the outer cyclone receptacle 160, but hingedly connected to the latter.

In greater detail, one side of the lower cover 170 is connected to the end of the outer cyclone receptacle 160 by a hinge 171. Thus, the cover 170 can be opened and pivoted about the hinge 171. On the other side of the cover 170, a locking element 172 is formed, while the outer cyclone receptacle 160 has a locking protrusion 173 formed thereon to selectively engage the locking element 172 of the cover 170.

As described above, since the lower cover 170 opens or closes pivotally, the reverse flow prevention pipe 180, which in the previous embodiment was formed on the lower cover 170, may interfere with the inner cyclone receptacle 150, thereby hindering smooth opening or closing of the lower cover 170. Accordingly, in this embodiment, the reverse flow prevention pipe 180 is integrally supported on a plurality of spokes

181, as shown in Figure 8, which are formed in a lower open end or opening of the inner cyclone receptacle 150.

Referring to Figures 5 and 6, in a third preferred embodiment of the invention, the upper cover 240 is a circular plate and has air inlet 241 and an air outlet 242 formed therein. When the dust collector 30 is mounted in the dust chamber 11 of the cleaner body 10, the air inlet 241 and air outlet 242 of the dust collector 30 are respectively interconnected to the air inlet 12 and outlet (not shown) of the dust chamber 11. Here, the air inlet 241 of the dust collector 30 is formed on an edge of the upper cover 240 to guide the air, which is drawn into the inner cyclone receptacle 250 through the air inlet 241, in a direction having a tangential component, i.e. in a diagonal direction. The air outlet 242 of the cyclone-type dust collector 30 is formed in the centre of the upper cover 240.

The inner cyclone receptacle 250 is substantially cylindrical and has open upper and lower ends. The upper cover 240 is mounted on or integrally formed with the inner cyclone receptacle 250. The cooperation of the inner cyclone receptacle 250 and the upper cover 240 causes a vortex of air having a centrifugal force to separate dust and contaminants from the air. Furthermore, the inner cyclone receptacle 250 has a contaminant outlet 251, formed in a central portion thereof, midway between upper and lower ends of the receptacle 250, through which the large particle contaminants that have been separated by the centrifugal force may be discharged. More specifically, the centrifugal force generated by the vortex current of air in the inner cyclone receptacle 250 separates the contaminants from the air. As the contaminants fall, the large particle contaminants are discharged through the contaminant outlet 251.

An outlet pipe 243 extends downward by a predetermined depth from the air outlet 242 of the upper cover 240. The outlet pipe 243 guides the reverse-ascending air from the bottom of the inner cyclone receptacle 250 through the air outlet 242 of the upper cover 240. It is preferable that the outlet pipe 243 extends downwardly to the extent that it is in registry with the contaminant outlet 251 of the inner cyclone receptacle 250.

The outlet pipe 243 has a first skirt 244 that extends downwardly from an end of the outlet pipe 243. This first skirt 244 prevents the collected dust and contaminants from floating upwardly with the reverse-ascending air. The outlet pipe 243 further includes a second skirt 245 that extends downwardly therefrom to guide the large particle contaminants discharged from the inner cyclone receptacle 250 through the contaminant outlet 251. The second skirt 245 has a gradually increasing diameter. Accordingly, not only is reverse flow of the large particle contaminants hindered, but also the minute particle dust can be efficiently separated and collected.

The outer cyclone receptacle 260 is substantially cylindrical and has open upper and lower ends. The outer receptacle 260 is joined with the upper cover 240 to surround the inner cyclone receptacle 250 coaxially. The outer receptacle 260 collects the large particle contaminants which have been discharged through the contaminant outlet 251 of the inner cyclone receptacle 250.

The inner cyclone receptacle 250 is downwardly tapered to have a gradually decreasing diameter. This decreasing diameter of the inner cyclone receptacle 250 works with the outer receptacle 260 to reduce flow velocity and to prevent contaminants collected in the outer receptacle 260 from ascending with the reverse-ascending vortex of air.

By opening the lower cover 270, which is removably mounted on the lower opening of the outer receptacle 260, the collected contaminants may be removed from the cyclone-type dust collector. The lower cover 270 is preferably screwed onto the outer receptacle 260.

As in the previously described embodiment, the dust collector further includes a reverse flow prevention pipe 280 that extends upward by a predetermined height from the centre of the lower cover 270. The pipe 280 hinders the reverse flow of the minute particle dust that has been collected in the inner cyclone receptacle 250 more efficiently.

Referring to Figure 6, air containing dust and contaminants flows diagonally into the inner cyclone receptacle 250 through the air inlet 241 of the upper cover 240, forming a vortex of air in the inner cyclone receptacle 250. Due to the centrifugal force of the vortex of air, dust and contaminants are separated from the air, then fall and are collected in the inner cyclone receptacle 250. Large particle contaminants are discharged through the contaminant outlet 251 to the outer cyclone receptacle 260. Dust is largely prevented from floating in a reverse direction due to the presence of the first skirt 244 and the reverse flow prevention pipe 280, and instead is collected in the inner cyclone receptacle 250. Also, the movement of the collected large particle contaminants in the outer cyclone receptacle 260 is restricted by the downwardly tapered structure of the inner cyclone receptacle 250 which causes a decrease in the flow velocity of the air. Accordingly, reverse flow of the contaminants is largely prevented. Furthermore, owing to the presence of the second skirt 245, the large particle contaminants are discharged through the contaminant outlet 251 more efficiently.

Meanwhile, the air, which descends in a circular motion along the inner circumference of the inner cyclone receptacle 250, ascends in a reverse direction after reaching the bottom, and is discharged through the outlet pipe 243.

Since small particle dust and large particle contaminants are separated from the air through two processes using centrifugal force, the dust and contaminants are separated and collected more efficiently.

Later, when the cyclone receptacles 250 and 260 are filled with contaminants, the user can separate the cyclone receptacles 250 and 260 from the cleaner body 10, open the lower cover 270 and dump the collected contaminants.

A fourth preferred embodiment of the present invention will now be described. Referring to Figure 7, the basic structure of the cyclone-type dust collector is substantially identical to that of the third preferred embodiment, and accordingly, description of the same elements will be omitted, but the main aspect of this embodiment, i.e., the lower cover 270 will be described in greater detail.

As shown in Figure 7, in the dust collector of the fourth preferred embodiment, as in the second embodiment, the lower cover 270 is not completely separable from the outer cyclone receptacle 260, but hingedly connected to the outer receptacle 260.

In greater detail, an edge of the lower cover 270 is connected to one end of the outer receptacle 260 by a hinge 271. Thus, the lower cover 270 can be opened and pivoted about the hinge 271. On an opposite edge of the lower cover 270 there is a locking element 272, while the outer receptacle 260 has a locking protrusion 273 that engages with the locking element 272 to selectively lock the locker 272.

Since the lower cover 270 is hingedly connected to the outer receptacle 260, the reverse flow prevention pipe 280 may interfere with the inner receptacle 250 if formed on the lower cover 270 as in the third embodiment. Accordingly, in this fourth embodiment, the pipe 280 is integrally supported on a plurality of spokes 281 at the lower opening of the inner cyclone receptacle 250, as shown in Figure 8.

In the above-described vacuum cleaner, dust and contaminants are separated from the air much more easily using the cyclone-type dust collector. That is, there is no need to employ or replace a dust filter which is expendable and unhygienic. Accordingly, the vacuum clean is more convenient in use. Furthermore, in a dust collector such as those described above, minute particle dust and large particle contaminants are separated from the air in two processes using centrifugal force, yielding a more effective cleaning process.

CLAIMS

1. An upright-type vacuum cleaner comprising:

a body having a dust chamber and a motor chamber formed therein;

a suction brush connected to the cleaner body for moving along a cleaning surface; and

cyclone-type dust collecting means removably disposed in the dust chamber of the cleaner body for separating by centrifugal force and collecting minute particle dust and large particle contaminants from air that is drawn in through the suction brush, the cyclone-type dust collecting means including:

an upper cover having a first air inlet corresponding to a suction hose for interconnecting the suction brush and the dust chamber, and an air outlet corresponding to an exhaust passage for interconnecting the dust chamber and the motor chamber;

a substantially cylindrical outer cyclone receptacle having open upper and lower ends, the outer cyclone receptacle being coupled to the upper cover;

an inner cyclone receptacle coupled to the upper cover and disposed in the outer cyclone receptacle; and

a lower cover mounted on a lower opening of the outer cyclone receptacle, the lower cover providing access to dust and contaminants collected in the inner and outer cyclone receptacles.

2. A cleaner according to claim 1, wherein the inner cyclone receptacle comprises a grille having a plurality of fine holes, and a second air inlet for guiding the air which passes through the grille into a vortex, thereby separating by centrifugal force and collecting the dust from the air.

3. A cleaner according to claim 1, wherein the first air inlet opens into the inner cyclone receptacle and is arranged to guide the air containing dust and contaminants into a vortex, the centrifugal force of the vortex separating the contaminants from the air, the inner cyclone receptacle having a contaminant outlet through which the separated contaminants are discharged into the outer cyclone receptacle.

4. A cleaner according to claim 2, wherein the first and second air inlets of the upper cover partially overlap each other.

5. A cleaner according to claim 2, wherein the upper cover comprises an outlet pipe, the outlet pipe extending downward from the air outlet and having a skirt, the skirt extending downwardly from an end of the outlet pipe and having a gradually increasing diameter, the skirt improving a dust collecting efficiency by increasing an air flow velocity.

6. A cleaner according to claim 5, wherein the outlet pipe has a spiral groove for increasing the said centrifugal force.

7. A cleaner according to claim 3, wherein the upper cover comprises an outlet pipe, the outlet pipe extending downwardly from the air outlet and having a first skirt extending downward from an end, the first skirt having a gradually increasing diameter to preventing reverse flow of contaminants collected in the inner cyclone receptacle.

8. A cleaner according to claim 7, wherein the outlet pipe comprises a second skirt extending downward from a middle level of the outlet pipe, the second skirt having a gradually increasing diameter to guide contaminants entrained in the air in the inner cyclone receptacle to be discharged through the contaminant outlet.

9. A cleaner according to any preceding claim, wherein the inner cyclone receptacle tapers downward from a middle level thereof to form a gradually increasing gap between the inner and outer cyclone receptacles, the gradually increasing gap decreasing a flow velocity of the air and preventing a reverse flow of contaminants collected in the outer cyclone receptacle.

10. A cleaner according to any preceding claim, further comprising a reverse flow prevention pipe extending a predetermined height from the centre of the inner cyclone receptacle to guide a reverse-ascending air vortex from the bottom of the inner cyclone receptacle and to prevent a reverse flow of contaminants.

11. A cleaner according to any preceding claim, wherein the lower cover is removably screwed to a lower opening of the outer cyclone receptacle.

12. A cleaner according to any preceding claim, wherein the reverse flow prevention pipe is integrally formed on a central portion of the lower cover.

13. A cleaner of any of claims 1 to 10, wherein the lower cover has a first side hingedly connected to a lower end of the outer cyclone receptacle, and a second side with a locking element formed thereon and engaging a locking feature formed on the outer cyclone receptacle, the hingedly connected lower cover allowing disposal of contaminants collected in the inner and outer cyclone receptacles.

14. A cleaner according to claim 10, wherein the reverse flow prevention pipe is integrally formed on a lower opening of the inner cyclone receptacle by a plurality of ribs.

15. An upright-type vacuum cleaner comprising:

a cleaner body having a dust chamber and a motor chamber, the motor chamber communicating with the dust chamber;

a suction brush connected to a lower end portion of the cleaner body;

cyclone-type dust collecting means removably disposed in the dust chamber to remove by centrifuging dust particles and larger particles from air drawn into the dust collecting means from the suction brush, wherein the dust collecting means comprise:

a substantially cylindrical outer receptacle having upper and lower ends;

an upper cover joined to and covering the upper end of the outer receptacle and having a first air inlet in registry with an intake duct interconnecting the suction brush and the dust chamber, and an air outlet in registry with an exhaust duct in communication with the motor chamber;

an inner cyclone receptacle disposed inside the outer receptacle and coupled to the upper cover, and

a lower cover mounted to the lower end of the outer receptacle and arranged to allow removal of the dust particles and larger particles collected in the inner and outer receptacles.

16. A cleaner according to claim 15, wherein the inner receptacle has an air inlet configured to promote rotational flow of air within the inner receptacle, and wherein the inner receptacle extends to an engages the lower cover.

17. A cleaner according to claim 15 or claim 16, wherein the inner receptacle is substantially cylindrical, and the upper cover includes an outer pipe which extends generally coaxially inside the inner receptacle and which has an open end spaced from the lower cover.

18. A vacuum cleaner constructed and arranged substantially as herein described and shown in the drawings.

INVESTOR IN PEOPLE

Application No: GB 0103042.8
Claims searched: 1-14

Examiner: Nicholas Mole
Date of search: 8 May 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B2P (P10B2A3, P10B2B, P10B2C, P1A) A4F FFD

Int Cl (Ed.7): B04C 5/26 A47L 9/16

Other: Online: WPI EPODOC JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2296879 A	(NOTETRY) See Fig 1 and Page 3 line 5 - page 5 line 26	1, 2, 4, 5, 11, 13 at least
Y	EP 0923992 A	(NOTETRY) See col. 4 para 15	1, 2, 4, 5, 11, 13 at least
Y	EP 0728435 A	(BLACK & DECKER) See Fig 3	1, 2, 4, 5, 11, 13 at least
Y	EP 0636338 A	(NOTETRY) See Fig 2 and Col. 3 line 23 - col. 6 line 16	1, 2, 4, 5, 11, 13 at least
Y	EP 0042723 A	(ROTORK) Fig 1	5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.